

# **Fundamentals of Water Conservation**

**Marlborough  
April 18, 2008**



# **Water Conservation in Industrial Cleaning Operations**

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# INDUSTRIAL CLEANING

## GENERAL DRIVERS

- Higher water prices
- Stricter regulations
- Water shortage
- Energy costs



# EFFICIENT INDUSTRIAL CLEANING

- Technology depends on application
- Measurements – know system parameters
- Identify cleaning process for raw materials, intermediate, and final products
- Identify equipment & cleaning process
- Formulate cleaning media or matrices to achieve required level of cleanliness





# AQUEOUS SYSTEMS

- Thousands of chemistries
- Effective on wide variety of soils
- No VOC contents
- Compatible with most construction materials
- Low basic costs



# INDUSTRIAL CLEANING

## **LIQUID**

- Water – Atomized, With Media
- Ultrasonic baths
- Chemical processes
- Pressurized – Low, Mid or High
- Hot Water

## **STEAM**

- Low/medium pressure, portable



# INDUSTRIAL CLEANING

## **SOLID (NON-WATER) MATRIX**

- Dry ice blasting or Cryogenic Cleaning
- Soda blasting
- Media – Sand, Glass, Plastic or Ceramic

## **PLASMA**

- Chemical radicals reacting to remove contaminants





# **WATER CONSERVATION OPPORTUNITIES FOR AQUEOUS SYSTEMS**

## **REDUCED WATER USE**

- Clean in place (CIP)
- Clean out of place (COP)

## **RECOVER, RECYCLE, REUSE**

**CHEMICAL TREATMENT**

**FILTRATION**



# **WASHING METHODS**

## **Drop-Fill Method – Batch**

**Reduce Dragout and Carryover**

**Mechanical - Extraction**

**Vacuum**

## **Countercurrent - Continuous**



# PINCH STUDY

- Analyses of Water and Energy Uses
  - Measure contaminants, temperature, and other relevant characteristics of wastewater streams
  - Identify which wastewater streams can be directly reused in other applications without treatment



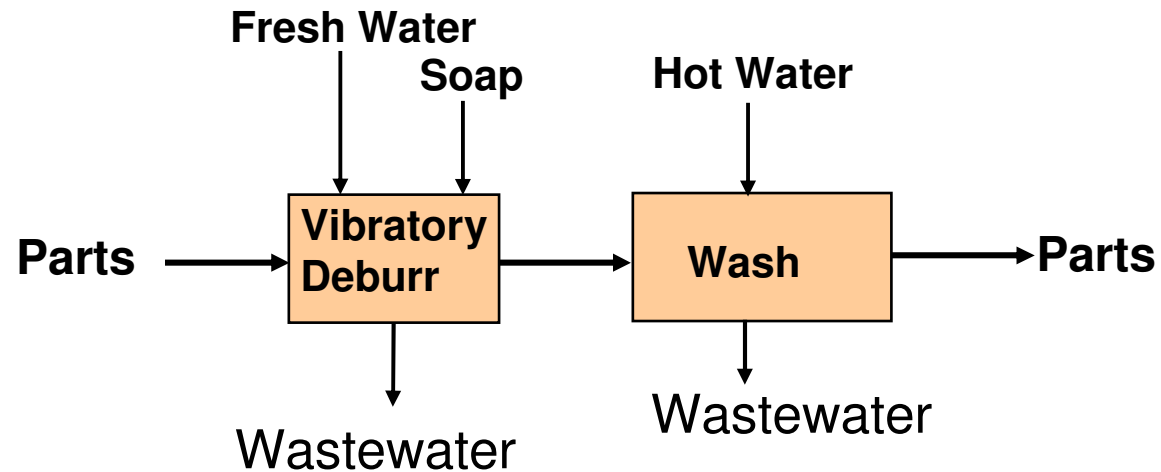
# REDUCING WATER CONSUMPTION FACILITY-WIDE

- Incorporate recycling, countercurrent operations, or wastewater treatment
- Closed-loop operations
  - Opportunity for facilities that face supply and/or discharge limits
  - Utilized where high-purity water is required
  - Reduce water consumption but increase energy consumption
  - May face different regulatory requirements

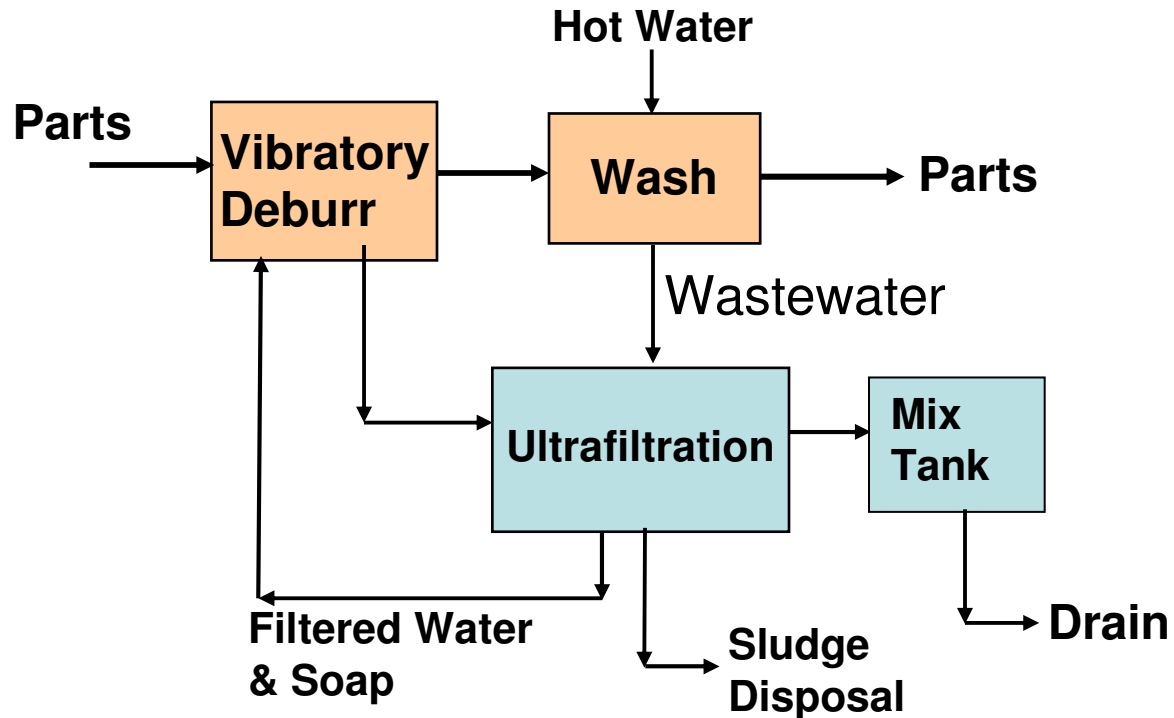


# ULTRAFILTRATION AND REUSE OF CLEANING WASTEWATER

**BEFORE**



**AFTER**







# RECLAIMED WATER

- **RECLAIMED WATER** – Wastewater that has been treated by a reclaimed water system so that it is suitable for beneficial reuse in accordance with 314 CMR 20.00
- **GREYWATER** – Any putrescible wastewater discharged from domestic activities including but not limited to washing machines, sinks, showers, bath tubs, dishwashers, or other source *except* toilets, urinals, and any drains equipped with garbage grinders.
- **BLACKWATER** – Wastewater from toilets, urinals, and any drains equipped with garbage grinders.



# RECLAIMED WATER – INDUSTRIAL REUSE

- Cooling
- Cooling towers
- Evaporative condensers
- Spray systems



# RECLAIMED WATER USE

- Wheelabrator Waste-to-Energy Plant, North Andover  
0.5 – 0.65 MGD from GLSD WWTP, North Andover for Cooling Tower Makeup - 1985
- Millennium Power Partners, Charlton  
0.4 MGD from Southbridge WWTP for Cooling Tower Makeup - 2004

Argonne National Lab ANL/EVS/R-07/3:

[http://www.ead.anl.gov/pub/doc/ANL-EVS-R07-3\\_reclaimedwater.pdf](http://www.ead.anl.gov/pub/doc/ANL-EVS-R07-3_reclaimedwater.pdf)



# RECLAIMED WATER

- DEP DRAFT REGULATIONS 314 CMR 20 (proposed)  
<http://www.mass.gov/dep/service/regulations/proposed/31420sum.doc>
- DEP INTERIM GUIDANCE DOCUMENT AVAILABLE ON WEBSITE:  
<http://www.mass.gov/dep/water/reuse.pdf>





# SUMMARY

## WATER CONSERVATION DURING CLEANING

- Establish Cleaning Parameters
- Determine Equipment and Process
- Check Recycling Options
- Make Process Countercurrent
- Consider Closed Loop Operation



# **NEED HELP? - CALL OTA**

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